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PATENT AND TECHNICAL TRANSLATION

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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/EP2005/051458, filed 03/31/2005, and published on 10/13/2005 as WO 2005/095245, and of fifteen (15) amended claims.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Specification

System Comprising Alternative Processing Sections for the Further Processing of Products, Longitudinal Folding Device and Method for the Synchronous Operation of a Folding Device

The invention relates to a system with alternative processing sections for the further processing of products, a longitudinal folding apparatus, as well as a method for the synchronous operation of a folding apparatus in accordance with the preambles of claims 1, 3 or 18.

In folding apparatuses, in particular for products of a rotary printing press, product sections are further processed in several successive and partially alternatively selectable processing stages. The alternative assignment of product sections to several processing stages takes place by means of a product shunt. In conventional folding apparatuses, the product shunt, as well as the tools of the subsequent processing stages, are mostly driven via gears from a main drive mechanism of the folding apparatus or its transport devices and are synchronized with them. However, if prior to their entry into the shunt and/or prior to their entry in the downstream located processing stage, the product sections are not always exactly oriented, damage to the products, a reduction in quality and/or even the stoppage of the installation can occur either in the course of the passage through the shunt or during subsequent further processing.

A product shunt of a folding apparatus with two downstream located longitudinal folding apparatuses is disclosed in DE 198 02 995 C2, wherein a sensor for detecting the phase relation of the product is located upstream of the product shunt, and a sensor is

located downstream of each of the two succeeding product sections for detecting jams in these sections. The three sensors, one sensor detecting the number of revolutions of the main drive mechanism, as well as a switching device setting a production type, are connected with a regulating arrangement for controlling the product shunt, which acts on a step motor which is connected with the shaft of the product shunt.

A longitudinal folding apparatus is known from DE 40 20 937 C2, wherein a folding blade can be moved toward and away from the folding apparatus via a cam disk.

DE 199 43 165 A1 discloses a folding blade of a longitudinal folding apparatus, which can be moved into and out of the folding apparatus by means of coils which generate electromagnetic force.

Longitudinal folding apparatuses are employed in the printing industry mainly in the finishing of printed products, wherein the printed products are pushed into the folding gap by the folding blade and are longitudinally folded in it. Because the entry direction of the printed products into the longitudinal folding apparatus extends transversely in respect to their subsequent movement through the folding gap, it is necessary to slow them down prior to their passage through the folding gap. Braking brushes, which gradually slow down the incoming printed products by means of friction, as well as stationary buffers, against which the printed products bump and are abruptly braked by this, are known for this purpose in known longitudinal folding apparatuses. To avoid damage to the printed products at the buffers, it is necessary to reduce the speed to a low value, but this value may in no case be zero, because in that case the printed products do not reach the buffer and a jam occurs. The

extent of the slow-down by means of the brushes is determined by the friction they exert on the printed products, and in the end by the position of the latter. If it is intended to fold printed products of varied thickness, while the position of the brushes remains the same, friction greatly increases with the thickness of the products, so that a thick product possibly gets stuck between the brushes and does not reach the buffer, while a thin one bumps against the buffer with such great speed that it becomes damaged in the process. Therefore the position of the brushes must be matched to the thickness of the printed products.

The friction between printed products and brushes is also a function of the surface condition of the printed products. Products made of smooth paper can bump against the buffer too rapidly, while products made of rough paper, but of the same thickness and the same weight, possibly do not reach the buffer.

A further problem arises from the fact that the kinetic energy of the printed products dissipated at the brushes is a result of the product of friction and length of the braking path. It is independent of the entry speed of the printed products. Changes of this entry speed, regardless of whether intentional or unintentional, therefore have a very strong effect on the bumping speed of the printed products on the buffer.

For all practical purposes it is therefore necessary to adjust the position of the brushes for each printing job in order to assure the correct functioning of the longitudinal folding apparatus. Based on the multitude of influencing parameters, the adjustment can often only take place empirically, which results in a large outlay of time and costs.

A further basic problem which occurs in connection with high entry speeds of the printed products, even when they are

braked to such an extent that damage because of bumping against the buffer does not occur, results from the fact that the printed products change their position and orientation in the course of the braking process. In many cases, following braking, a printed product assumes a twisted position in the longitudinal folding apparatus, in which the front edge of the printed product no longer extends perpendicular to the folding gap. The printed product is therefore not folded in the desired way in the center in the course of subsequent folding, during which the printed product is pushed into the folding gap by the folding blade, but has an oblique fold.

Premature folding can also occur if printed products enter the longitudinal folding apparatus delayed and driving of the folding blade (tool of the processing change) is provided by a main drive mechanism.

The object of the invention is based on increasing the product quality and operational dependability in a system with alternative processing section for the further processing of products and in a longitudinal folding apparatus, as well as on the creation of an appropriate method for the synchronous operation of a folding apparatus.

In accordance with the invention, this object is attained by means of the characteristics of claims 1, 3 or 18.

The advantages which can be obtained by means of the invention consist in particular in that on the one hand the product quality, and on the other hand the operational dependability (availability) of the folding apparatus, are considerably increased. This is advantageously assured by means of the optical detection of the position of the products upstream of the two longitudinal folding apparatuses and the

synchronization of the folding blade, which is driven mechanically independently from the conveying system and/or a movable buffer and/or an optical detection of the position of the products upstream of the shunt.

By means of the optical detection of the phase relation of the products directly prior to longitudinal folding it is possible to ideally synchronize the time of folding and to correct it if required. The quality is further improved if in addition movable buffers are also synchronized by means of optical detection and reduce the bumping and assure an exact product alignment.

In an advantageous embodiment a gentle braking of the products, for example printed products, is achieved at the longitudinal folding apparatus by means of the movable buffer, because the kinetic energy with which the products bump against the moving buffer is reduced in comparison with the kinetic energy which is released in case of bumping against a stationary buffer. If the difference between the entry speed of the products and the speed of the moving buffer is selected to be sufficiently low, it is even possible to completely prevent the mentioned unintentional effects as a result of released kinetic energy. It is possible in this case to also absorb very high entry speeds of the products by means of the movable buffer and the products can be gently braked. A braking effect, which is independent of the mass, thickness and surface condition of the incoming products, can be achieved by means of the movable buffer, so that it is possible to process different products without it being required to first adapt the longitudinal folding apparatus to them.

In a particularly preferred manner the longitudinal folding apparatus contains a control unit which controls a reduction of the speed of the buffer on the braking path. A definite braking of

the incoming products is possible by means of the control unit in that they come to a buffer at a predetermined defined position and in the process are optimally aligned for the subsequent folding process, or that they bump against a second, stationary buffer, which determines the desired position of the products for the subsequent folding process, at a reduced speed, at which no damage of the products because of their bumping is to be expected.

If the control unit has an input for a signal which in particular is representative of the entry speed of the products, it is possible to comfortably match the speed of the buffer with changing entry speeds of the products by means of the control unit.

A sensor for detecting incoming products is advantageously placed upstream of the braking path and is coupled to the control unit, so that the control unit can synchronize the movement of the movable buffer in such a way that at the entry to the braking path a detected incoming product meets the buffer which moves at approximately the entry speed. The speed of the buffer at the entry to the braking path can be less than the entry speed as long as the difference between the speeds is not too great so that damage to the product appears likely. It can also be slightly greater, and in this case contact between the two will then occur at a later location on the braking path, at which the buffer has become slower than the product.

Preferably the buffer is designed as a revolving cam, whose direction of movement crosses a braking path of the product at least on one path section. With the aid of a revolving cam arranged on a rotatable body, for example a disk, a roller or an eccentric device, the buffer can be conveyed in continuous movement without a reversal of the driving direction from one end

of the braking path - i.e. moving out of contact with the product - back to its start - i.e. coming into contact -, in order to catch the next arriving product there. In this case the rotatable body can either be provided as a module which can be retrofitted to the longitudinal folding apparatus and is located above a folding table having the folding gap, or the rotatable body with the cam is arranged underneath the folding table as a module fixedly integrated into the longitudinal folding apparatus. In a preferred embodiment the body consists of several disks, which are arranged axially next to each other, each of which has at least one cam on its circumference.

In a variation the cam can be arranged on a circulating endless belt, which has a section which extends parallel with the braking path.

Preferably at least one rotatable body having a cam, or endless belt, is arranged on both sides of the folding gap, each of which supports synchronously moved buffers. Respectively two rotatable bodies, or endless belts, per side of the folding gap are preferred here. In this way a correct alignment of the braked product is assured, and unintended twisting of the product in relation to the folding gap is additionally made more difficult.

At least one motor for driving the rotatable bodies, or the endless belts, can be provided on both sides of the folding gap. This motor can be a highly dynamic servo motor or an electric motor. However, an embodiment is also possible wherein a single motor drives the rotatable bodies or endless belts on both sides of the folding gap by means of a continuous shaft.

A speed of the buffer at the entry to the braking path of at least 90% of the entry speed of the product is preferred, since in that case a sufficiently small difference exists between the

speed of the buffer and the entry speed, so that only little kinetic energy is released when the products bump against the buffer.

It can be advantageous to also provide braking brushes, besides the movable buffer, in the longitudinal folding apparatus, by means of which braking of the products can be further gentled.

An exemplary embodiment is represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a longitudinal folding apparatus in a lateral view,

Fig. 2, the longitudinal folding apparatus in a view from above,

Fig. 3, the process of braking a printed product a) to d),

Fig. 4, a speed/time diagram for a printed product in a first mode of operation of the longitudinal folding apparatus,

Fig. 5, a speed/time diagram for a printed product in a second mode of operation of the longitudinal folding apparatus,

Fig. 6, a further longitudinal folding apparatus in a lateral view,

Fig. 7, the longitudinal folding apparatus from Fig. 6 in a view from above,

Fig. 8, a perspective representation of a braking device with a movable buffer,

Fig. 9, a perspective representation of a braking device with a folding table and frame,

Fig. 10, a schematic representation of a system with alternating processing sections for the further processing of products.

A processing stage 01 designed as a longitudinal folding apparatus 01 is represented in Figs. 1 and 2, once in a lateral

view (Fig. 1) and once in a view from above (Fig. 2). The longitudinal folding apparatus 01 consists of a folding table 04, in which an elongated folding gap 06 is provided. A pair of folding rollers 07 which have been placed against each other and of which only one is visible in Fig. 1, while the other is hidden, are arranged underneath the folding table 04 at the level of a folding gap 06 in such a way that they form a gap which is oriented parallel with the folding gap 06 and is located directly underneath it. Pivotable folding levers 21 are provided on the folding table 04, which hold a folding blade 03 above the folding gap 06, which is also oriented parallel in respect to the folding gap 06. In the course of the pivot movement of the folding levers 21, the folding blade 03 can enter into the folding gap 06. In an end area of the folding gap 06 an elongated buffer 08 is arranged transversely in respect to the folding gap 06 on the folding table 04. Braking brushes 09 facing the top of the folding table 04 are fastened on the buffer 08. In contrast to a rotating cutter, the folding blade 03 is preferably embodied in the manner of a blade 04, which is pivotable in respect to the folding table 04, i.e. it can be moved up and down relative to the folding table 04. For example, the blade 04 is seated in levers 43, which in turn are pivotably seated around a shaft 44 (Fig. 9) in respect to the folding table 04. However, in another embodiment the blade can also be arranged eccentrically on a continuously turning rotatory body. It can also be eccentrically arranged on a turning planetary wheel. In an advantageous embodiment a mechanically independent drive mechanism (see below) has been provided.

In a preferred embodiment - merely indicated by dashed lines in Fig. 1 - its own drive mechanism 05, which is independent of the conveying or production devices, is assigned to the folding

blade 03. This drive mechanism 05 can be designed as a motor 05, for example, which lowers or raises the folding blade 03 in a clocked manner in respect to the position of a product 02 on the folding table 04 via a gear mechanism, for example an eccentric device or a crank drive. For example, the control of the drive mechanism 05 takes place by means of a control device 10, which is represented in dashed lines, and which synchronizes the movement of the folding blade 03 with the product flow, either by means of information regarding the speed of a transport system conveying the product 02, or by means of a signal from a sensor (for example the below mentioned sensor 18), which is arranged upstream of the folding gap 06 and detects the product 02.

A rotatable body 15, for example disks 15, is respectively arranged on both sides of the folding gap 06, whose axis of rotation extends perpendicular in respect to the folding gap 06. Respectively two buffers 13, 14, for example cams 13, 14, are arranged, for example welded to the circumference of the disks 15 wherein, starting from any one of the cams 13, 14, a respective distance between the cams 13, 14 along the length of the toothed belt 12 preferably is of the same length. Each of the two disks 15, which are located on different sides of the folding gap 06, is connected with a motor 16, for example with an orientation-regulated electric motor 16, and is preferably synchronously driven. In a non-represented variation the two disks 15 are connected with each other by means of a continuous shaft and are driven by a common motor 16 (see remarks below in regard to Fig. 17). A braking path 24 for printed products 02 is delimited on the one side by the surface of the folding table 04, on the other by a shell face of the two disks 15 facing this surface. The distance between the surface of the folding table 04 and the shell

faces of the disks 15 is less than the height of the cams 13, 14. The motors 16 are controlled by a control unit 19, or control device 19, which is furthermore connected to a sensor 18. For the detection of products 02, for example printed products 02, entering the brake path 24 delimited by the toothed belts 12 and the folding table 04 at an entry speed v_0 (Figs. 5 and 6), the sensor 18 has been placed upstream of the braking path 24 on the inlet side. The control unit 19 furthermore has an input for a signal specifying the speed v with which the printed products 02 enter the braking path 24. For example, this signal can be derived from a web speed signal of a web-fed printing press producing the printed products 02, or can be made available from the control console of such a press. However, it is also possible to detect the speed v of each individual arriving printed product 02, for example with the aid of two sensors 18 being successively passed by the printed products, and to provide it to the input of the control unit 19.

In a variation (Fig. 6, 7) of the disk 15 supporting the cams 13, 14, a toothed belt 12 in the form of an endless belt 12, which extends parallel with the folding gap 06, runs on both sides of the folding gap 06 over two rotatably seated gear wheels 11, for example pulleys. Two buffers 13, 14, for example cams 13, 14, have been respectively welded to the toothed belt 12 wherein, again starting from any one of the cams 13, 14, a distance between the cams 13, 14 along the length of the toothed belt 12 is of the same length. Two of the gear wheels 11, which are located on different sides of the folding gap 06, are here connected with each other by means of the continuous shaft 17 and are connected with the common motor 16, for example with an orientation-regulated electric motor 16, and are synchronously driven. The

braking path 24 for the printed products is delimited on the one side by the top of the folding table 04, on the other side by a strand of the two toothed belts 12 facing this surface. The distance between the surface of the folding table 04 and the strands of the two toothed belts 12 is slightly less than the height of the cams 13, 14. The motor 16 is controlled by the control unit 19 which, as mentioned in connection with Fig. 1, is connected to the sensor 18 (see above).

In a non-represented embodiment the disks 15, or the endless belts 12 and gear wheels 11, can be arranged on a side of the folding table 04 facing away from the printed product 02, wherein the cams 13, 14 must extend through the folding table 04 in such a way that they project out of the surface facing the printed product 02 in the manner of a movable buffer for the printed product, at least over a portion of the path.

The process of braking of the incoming printed product 02 is represented in Figs. 3a) to 3d) by means of the example of the rotatable body 15, wherein the representation of the folding blade 03 and the folding rollers 07 has been omitted for the sake of clarity. Wherever possible, the embodiment with an endless belt 12 was shown in parentheses.

The printed product 02 entering the longitudinal folding apparatus 01 at an entry speed v_0 is detected by the sensor 18 in Fig. 3a). By means of the signal present at the input of the control unit 19 (time of the detection of the product and/or speed signal), the control unit 19 synchronizes the movement of the disks 15 (toothed belt 12) with that of the printed product 02 in such a way that, at the entry to the braking path 24, the printed product 02 meets a cam 13 or 14, in Fig. 3b) the cam 13, which at this time moves slower than the printed product 02 and in this way

brakes it without damaging it. In the course of the passage of the cam 13 through the braking path 24 in Fig. 3b), the control unit 19 continuously slows the rotating movement of the disks 15 (the movement of the toothed belts 12) until the printed product has for example reached the braking brushes 09 and is slowed further by them, and finally encounters the buffer 08 at a speed v, at which it is not damaged by bumping. However, in case where the braking brushes 09 are only arranged downstream of the location at which the printed product 02 comes out of engagement with the cam 13, the printed product 02 initially moves evenly at a reduced speed. Fig. 3c) shows the situation shortly before the encounter of the printed product 02 with the buffer 08, and Fig. 3d) the situation shortly after the encounter of the printed product 02 with the buffer 08. As soon as the cam 13 and the printed product 02 come out of engagement, the disk 15 (the toothed belt 12) can be accelerated again, so that the second cams 14 are located at the entry to the braking path 24 in time with the arrival of a subsequent printed product 02 and have a speed v suitable for braking this printed product 02.

In a simplified embodiment of the longitudinal folding apparatus 01 the braking brushes 09 can be omitted. However, in this case it is necessary to brake the cams 13, 14 to a lower speed v when passing the buffer 08 than if there were braking brushes 09 in order to prevent damage of the printed products 02 at the buffer 08 and their rebounding. Therefore a larger capacity motor 16 is required.

In the subsequent folding step the printed product 02 is pushed by the folding blade 03 through the folding gap 06 into the gap between the two folding rollers 07 in a known manner and is longitudinally folded in this way. This is a generally known

process, so that it will not be addressed in greater detail at this point.

By way of example, Fig. 4 shows the chronological development (t) of the speed v of a printed product 02 during its passage through the braking path 24.

The printed product 02 enters the longitudinal folding apparatus 01 at an entry speed v_0. The cams 14 or 13 precede the printed product 02 at a speed v_1, which is 90% of the entry speed v_0. In the course of the bumping of the printed product 02 against the cams 14 or 13 at the time t_0, the relative speed between the printed product 02 and the cams 14 or 13 therefore is one tenth of the entry speed v_0. Because the relative speed enters the kinetic energy quadratically, this means that in the course of the bumping of the printed product 02 against the cams 14 or 13 at the time t_0 only one hundredth of the kinetic energy is released which would be released in case of the bumping of the printed product 02 against the buffer 08 at an unbraked entry speed v_0.

The speed of the cams 14 is continuously reduced by the control unit 19 between the time t_0 and the time t_1 at which the printed product 02 gets into the effective range of the braking brushes 09. A descending straight line for the speed results between these times in the speed/time diagram. Braking by the control unit 19 can also take place in a differently shaped curve. Starting at the time t_1, the printed product 02 is additionally braked by the braking brushes 09, so that the straight line between the times t_1 and t_2 shows a curvature. When the printed product 02 finally bumps against the buffer 08 at the time t_2, where it is completely braked, it shows a very slow speed v_2 in comparison to the entry speed v_0. Therefore bumping of the

printed product 02 against the buffer 09 is very gentle and hardly any kinetic energy is released. Starting at the time t_1, at which the contact between the printed product 02 and the cams 14 becomes lost, the control unit 19 can accelerate the toothed belt 12 again in order to synchronize the cams 13 or 14 with the following printed product 02.

Fig. 5 shows the development of the speed v of a printed product 02 in the course of passing through the braking path 24 in connection with a further simplified design of the longitudinal folding apparatus 01, wherein the disk 15 supporting the cams 13, 14 (or the endless belts 12) is driven at a constant speed. Here, too, the printed product 02 enters the longitudinal folding apparatus 01 at the entry speed v_0. This time the cams 14 or 13 precede the printed product 02 at a speed v_3, which is reduced in comparison with the speed v_1. At the time t_0 the printed product 02 has caught up with the cams 14 or 13 and bumps against them, so that its speed v is reduced from v_0 to v_3, the speed of the cams 14 or 13. Between the time t_0 and the time t_1, at which the printed product 02 reaches the effective range of the braking brushes 09, the speed v_3 of the cams 14 or 13, and therefore the speed v of the printed product 02, remains approximately constant. However, for the disk 15 this only applies approximately to a contact range within a narrow angle of rotation, for example less than 20°. Following the vertex of the cam 13, i.e. the point of the shortest distance from the folding table 04, which is distinguished in that the line which connects the center of the disk 15 with the front edge of the cam 13 extends perpendicularly in respect to the plane of the folding table 04, at a constant rotary speed the cam 13 runs away from the braked printed product

02 in the plane of the folding table 04 at a slightly faster speed (this is not represented in Fig. 5).

The printed product 02 is further braked by the braking brushes 09, which becomes noticeable by a curvature of the graph which had been straight up to that time, while the cams 14 or 13 continue to run, so that they become again separated from the printed product 02. Finally, at the time t_2 the printed product 02 bumps against the buffer 08 at the speed v_4 and is completely braked.

If, for a simpler estimation, the effect of the braking brushes 09 on the speed v is not considered by assuming that no braking brushes 09 were provided, and if it is further assumed that the speed v_3 of the cams is half the size of the entry speed v_0 of the printed product 02, the same amount of kinetic energy is released during the bumping of the printed products 02 against the cams 14 or 13 and in the course of the bumping of the printed product 02 against the buffer 08, since during both bumping processes respectively the same amount of relative speed between the printed product 02 and the cams 14 or 13 at the buffer 08 prevails. This means that during both bumping processes respectively just one fourth of that kinetic energy is set free which would be released if the printed product 02 would bump against the stationary bumper 08 at the unbraked entry speed v_0. If braking brushes 09 are provided, it is possible to select $v_3 > v_0/2$, and $v_4 > v_0/2$, and both bumping processes are softened.

In an advantageous embodiment with the disk 15, the bumping point is located ahead of the vertex of the cam 13, i.e. ahead of the point of the shortest distance from the folding table 04, which is distinguished by the line which connects the center of

the disk 15 with the front edge of the cam 13 extending perpendicularly in respect to the plane of the folding table 04.

The longitudinal folding apparatus 01 with disks 15, or endless belts 12, arranged underneath the folding table 04 is preferred in particular in the case in which it has been provided that the disks 15, or the endless belts 12, together with the gear wheels 11, as well as the motor 16/the motors, have been fixedly installed in the table, while the longitudinal folding apparatus 01 with disks 15, or endless belts 12, arranged above the folding table 04 is preferred in actuality in the case where the toothed belts 12 with the gear wheels 11 and the motor 16 are intended to be designed as a removable module.

Fig. 8 shows an advantageous embodiment of a braking arrangement 26 having a movable buffer 13, 14. It has a group of several, here four, disks 15 on both sides of the folding gap 06, each of which supports one cam 13 on the circumference, and each group is driven by a motor 16. In principle, this arrangement could be connected releasably or non-releasably with a frame 27 or support 27, or the folding table 04 (Fig. 9). However, in an advantageous arrangement the braking device 26 is designed as a module 26 which is arranged movable in respect to the frame 27 in such a way that the space directly above the folding table 04 can be kept clear. To this end, the braking device is seated so that it is pivotable in respect to the frame 27. The braking device has groups of supports 29 for receiving the disks 15, which are either pivotable around a shaft 28 fixed in place on the frame, or are pivotable around a shaft 28 which is rotatably seated on the frame 27. Pivoting can take place either manually or, as represented, by drive means 31, for example one or several cylinders, which can be charged with a pressure medium. To this

end the cylinder is designed to be fixed on the frame, for example, and the piston end is hinged to the supports 29, or vice versa. Fixed on the frame here includes that the seating of the shaft 28, or of the cylinder, can be connected with further components, which are arranged in a fixed orientation in respect to the frame 27 or the folding table 04. If now the folding table 04, or the folding blade 03 is to be made accessible, the braking device is pivoted away by actuating the drive means 31 (or manually). The module 26 - whether arranged movably or fixed on the frame - is suitable in a particularly simple manner for retrofitting conventional longitudinal folding apparatuses 01.

The principle of the movable buffers 13, 14, as well as the particular embodiments of the arrangement can be advantageously used, considered by themselves, but also as a whole within a system 32 with alternative processing sections.

Fig. 10 schematically shows a system 32 with alternative processing sections for further processing products 02, for example intermediate products 02, in particular for the further processing of printed products 02 in a folding apparatus.

Intermediate products 02, for example already transversely cut and/or transversely folded sections of printed products, are conveyed along a track 33, for example a conveying track 33, toward a shunt 34, for example a splitting device 34, where the further transport track is split into several (here two) alternative tracks 36, 37, for example transport tracks 36, 37, in particular processing tracks 36, 37, for further processing of the intermediate products 02. The splitting device 34 has, for example, tongues 38, for example splitting tongues 38, which are arranged to be movable in such a way that, depending on the position of the tongues 38, the incoming product 02 is guided into

one or the other transport track 36, 37. In this way it is possible, for example, to alternatively guide respectively one product 02 into one or the other transport track 36, 37 and to feed it to two different downstream located processing stages 01. Transporting of the products 02 on the tracks 33, 36, 37 can in principle take place in the most diverse manner by means of transport systems, for example belt or chain conveyors, or by means of belt or belt systems enclosing the products 02 on both sides. The transport systems of the tracks 33, 36, 37 can be driven by several drive mechanisms, which are independent of each other, or by a common drive mechanism.

In conventional systems, clocking or synchronization of the splitting device 34, or splitting tongue 38, with the product 02 takes place mechanically by coupling with the drive mechanism of a processing stage and/or of the transport system. The disadvantage here lies in that products 02 which have slipped in respect to the transport system, or products 02 which were supplied too late or too early to the transport system, pass the shunt 34 at the wrong moment, so that incorrect guidance, or even jamming and a stop, can result.

The system 32 represented in Fig. 10 is designed with an optical detection device of the position of the products, or the phase relation of the products. For this purpose the system has a sensor 39 for detecting a position of the products, or phase relation of the products, for example an optical sensor 39, preferably at a short distance upstream of the shunt, such as, for example, at most five product lengths, particularly advantageously less than two product lengths. The sensor can detect the entry of the product 02 into the field of view, the exit from the field of view and/or its transport speed, and can output an appropriate

signal. The signal is provided to a control device 41, which in turn controls a drive mechanism 42 of the shunt 34. The control device 41 is designed to synchronize the phase relation of the shunt 34 by means of the signal, in particular the position or phase of the splitting tongue 38, with the arrival of the product 02.

In a first variation of a discontinuously operated drive mechanism 42, the shunt 34 is brought into the required position by the drive mechanism 42, for example by means of respective signals. This means that a shunt placement, respectively caused by a signal, is provided in the sequence of the detected products. A number of products 02 possibly located on the path between the shunt 34 and the distant sensor 39 must be taken into consideration if the distance is more than one product length 02.

In an advantageous variation the drive mechanism 42, for example designed as a motor 42, is operated continuously and drives the splitting tongue 38 by means of a gear, for example a crank gear. The number of revolutions and/or the position of the motor 42 is set by the control device 41, synchronized to the product flow in such a way that, when a product 02 enters the shunt 34, the splitting tongue 38 is in the desired position. For example, this takes place by taking into consideration the distance between the sensor 39 and the shunt 34 and the product speed. The latter can be detected, for example either by means of the sensor 39, or can be taken from information regarding the speed of the transport system on the conveying track 33. If the phase relation and/or phase velocity between the signal for detecting the product 02 and that of the splitting tongue 38 no longer agrees, a correction of the rotary position and/or number of revolutions of the drive mechanism 42 by means of the control

device takes place. The exact synchronization between the product entry into the shunt 34 and the shunt position is possible by means of this.

The described optical detection in the approach area of the shunt 34, along with the appropriate control of the shunt 34 is in principle advantageously usable in systems with alternative transport track 36, 37 for the products 02. However, this applies in particular within the framework of a system 32 with alternative processing tracks 36, 37 for intermediate products 02, in particular for printed products 02, whose product flow is split in accordance with fixed standards, or is guided into a definite processing track, and the split product flows are intended to be conducted to different processing stages for further processing. Such processing stages can basically be folding, gluing, labeling, stamping, stacking, binding and/or stapling devices. In conventional systems the clocking or synchronization of the processing stage, for example the folding blade 03 of a folding apparatus, with the product 02 takes place mechanically by coupling with the drive mechanism of an upstream or downstream arranged processing stage and/or with the transport system conveying the product 02. Again, the disadvantage here is that products 02 which have slipped in respect to the transport system, or products 02 which were supplied too late or too early to the transport system, can block the processing stage, or at least can lead to erroneous product processing - for example a wrongly placed fold. Furthermore, increased wear of the transport system, for example the belt system, or of the processing stage itself can be the result.

Therefore the system 32 represented in Fig. 10 is designed with the optical detection of the product position upstream of the

processing stage. It has two processing tracks 36, 37, each with a processing stage in the form of a longitudinal folding apparatus having a tool embodied as a folding blade. The longitudinal folding apparatuses can be conventional longitudinal folding apparatuses, or advantageously longitudinal folding apparatuses 01 in one of the above mentioned embodiments with a disk 15, or endless belt 12, which have a tool 03 embodied as a folding blade 03 - in particular a mechanically independently driven one.

The upper and/or the lower longitudinal folding apparatus 01 (preferably both) has a drive mechanism 05 for the folding blade 03, which is mechanically independent from the transport system, as well as a sensor 18 located upstream of the folding gap 06 for selecting the position, or a passage time, of a product 02, i.e. the product phase relation. The movement of the folding blade 03 can be synchronized by means of the control device 10. The sensor 18 detects the time of the passage of a product 02, whereupon the synchronization of the movement of the folding blade 03 or, in case of a deviation from a desired value, the folding time, are corrected by the control device 10. If the longitudinal folding apparatus 01 additionally has a movable buffer 13, 14 in the embodiments mentioned above, it can also be synchronized via the associated control unit 19 (see Figs. 1 to 3). The control units 10 and 19 can here be structurally combined and, if desired, can be a part of a higher order control arrangement.

A particularly advantageously embodied system 32, in which a product flow is split in accordance with fixed standards, and the split product flows are intended to be fed to different processing stages for further processing, in particular to longitudinal folding apparatuses 01, are designed with an above mentioned optical detection device for detecting the product

position upstream of the shunt 34, as well as upstream of or in the entry area of the processing stages.

The described longitudinal folding apparatuses 01 are preferably embodied as a so-called third fold, upstream of which a first longitudinal folding unit, for example a former, as well as a transverse folding apparatus, for example a folding jaw cylinder working together with a folding blade cylinder, are arranged.

List of Reference Numerals

01	Longitudinal folding apparatus, processing stage
02	Product, printed product, intermediate product
03	Folding blade
04	Folding table
05	Drive mechanism, motor
06	Folding gap
07	Folding roller
08	Buffer
09	Braking brush
10	Control device
11	Gear wheel
12	Toothed belt, endless belt
13	Buffer, cam
14	Buffer, cam
15	Body, rotatable, disk
16	Motor, electric motor
17	Shaft
18	Sensor
19	Control unit, control device
20	-
21	Folding lever
22	Product, printed product
23	Longitudinal folding apparatus
24	Braking path
25	-
26	Braking device, module
27	Frame, support

28	Shaft
29	Support
30	-
31	Drive means
32	System
33	Track, conveying track
34	Shunt, splitting device
35	-
36	Track, transport track
37	Track, transport track
38	Tongue, splitting tongue
39	Sensor
40	-
41	Control device
42	Drive mechanism, motor
43	Lever
44	Shaft
t	Development, chronological
t_0	Time
t_1	Time
t_2	Time
v	Speed
v_0	Entry speed (02)
v_1	Speed (14, 13)
v_2	Speed (02)
v_3	Speed (02)
v_4	Speed (02)